

AMENDED SPECIFICATION

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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Floorings

We, THE MARLEY TILE COMPANY LIMITED, a British Company, of Riverhead, Sevenoaks, Kent, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is concerned with improvements in or relating to floorings, and particularly with a method of laying a flooring possessing antistatic and/or conductive properties.

Many types of flooring such as for example plasticised polyvinyl chloride flooring have electrostatic properties resulting in the build up of electric charge caused for instance by friction on the surface thereof. Such a charge is liable to discharge to earth by means of a spark discharge and thus plasticised polyvinyl chloride and like materials having insulating properties are unsuitable for use in situations where sparking is liable to prove dangerous, for example, where explosive substances are to be found. Such dangers arise for example in hospital operating theatres where anaesthetics which form explosive mixtures with air are frequently used.

It has therefore been proposed to provide conductive or antistatic flooring to avoid the possibility of sparking, the flooring material incorporating a conductive substance whereby the material is rendered conductive. Such conductive flooring materials are laid upon an appropriate substrate of flooring base. A disadvantage with conductive floorings of this sort is that an electric shock received by someone in contact with the flooring is liable to be severe, if the resistance to earth of the flooring is small. There are thus in existence

in many countries including Great Britain safety regulations which specify a minimum flooring to earth resistance for certain types of flooring such as hospital flooring. The position is complicated by the fact that different countries, and even different bodies in the same country, specify varying minimum resistances.

It has been proposed to provide conductive or antistatic flooring in which the conductive substance in the flooring material provides the necessary minimum flooring to earth resistance for certain types of flooring. This flooring has been laid on an insulated layer and in this case the conductive layer is connected to earth via metal strips.

It will thus be appreciated that there are two conflicting desiderata for antistatic floorings. First, to avoid the risk of sparking, one requires a low surface to surface resistance coupled with a low surface to earth resistance. On the other hand, to minimise the affect of electric shock, one requires a relatively high surface to earth resistance. It is necessary to compromise and select a surface to earth resistance which on balance is the most desirable; the most advantageous value may vary according to the circumstances, environment etc. in which the flooring is to be used.

Where a conductive or antistatic flooring is laid directly on a flooring base, the surface to earth resistance of the flooring will be dependant upon the electrical properties of the base. A wood flooring base for example has a relatively high electrical resistance and thus a flooring laid thereon would have a high surface to earth resistance. Concrete on the other hand may have a relatively low electrical resistance especially when having a high mois-

ture content, and a flooring laid on a concrete base may thus have a low surface to earth resistance. In effect the electrical properties of substrates upon which anti-static flooring materials may be laid are likely to be extremely variable so that very variable resistance to earth values may be obtained.

It is an object of the present invention to provide a method of laying a flooring possessing antistatic and/or conductive properties, which method is adapted to allow of the production of a flooring having a predetermined and adjustable surface to earth resistance whatever be the nature of the flooring base or substrate. By such a method, one can first determine the most desirable surface to earth resistance for a particular flooring, and then produce a flooring having that resistance.

According to one feature of the invention therefore, we provide a method of laying a flooring possessing predetermined antistatic and/or conductive properties which comprises first providing the flooring base with an electrically-insulating layer, applying on to the said insulating layer a conductive wear layer and providing an electrical connection from the conductive wear layer to earth via a predetermined resistance which is selected to provide the desired antistatic and/or conductive properties. It will in general be convenient to apply the wear layer to the insulating layer using an adhesive, and in such cases the adhesive itself will advantageously be electrically conductive to improve surface to surface conductivity of the flooring.

According to a further feature of the invention, we provide a flooring possessing predetermined antistatic and/or conductive properties which comprises, on a flooring base, (1) an electrically-insulating layer and (2) a conductive wear layer separated from the flooring base by the said insulating layer, there being provided an electrical connection from the conductive wear layer to earth via a predetermined resistance which is selected to provide the desired antistatic and/or conductive properties.

The first step in the method according to the invention is thus the formation of an electrically-insulating layer on the flooring base. This layer may be of any convenient material, and according to a preferred feature of the invention is of thermoplastic sheeting such as, for example, polythene polyvinyl chloride or other polyvinyl sheeting. The sheeting should be of sufficient thickness to ensure electrical insulation and in general it has been found that a thickness of at least 0.005 inches is desirable. The sheeting is conveniently applied to the flooring base using a non-aqueous adhesive, aqueous adhesives tending to affect the electrical insulating properties of the sheeting. Suitable adhesives include non-aqueous bitumen adhesives such as, for

example, Marley No. 3 Adhesive as sold by the Marley Tile Company Limited.

Alternatively, the electrically-insulating layer may be formed by applying one or more coatings of a hardenable resin composition, the resin being hardened after application. Epoxy resin compositions are particularly preferred and examples of epoxy resins suitable for inclusion in such compositions include the proprietary materials "Epikote" epoxy resin, (as sold by the Shell organisation) and "Araldite" RY152 (as sold by Ciba), the words "Epikote" and "Araldite" being registered Trade Marks. The epoxy resin composition also advantageously contains a non-aqueous non-conductive filler, an example of a suitable material being sand, as well as an epoxy resin hardener which in the case of the two specific epoxy resins referred to above is conveniently "Epikure" RTV (the word "Epikure" being a registered Trade Mark) and "Araldite" HY152 respectively. In one method of applying the insulating layer, a first coating of epoxy resin composition containing 1 part of resin, 1 part of hardener and 8 parts of filler is formed on the flooring base, and on this first coating is added a second coating consisting essentially of resin and hardener alone. The coatings are allowed to harden before application of the conductive wear layer, and as in the case of thermoplastic sheeting the total thickness of the insulating layer is preferably at least 0.005 ins. An epoxy resin insulating layer has an advantage over a thermoplastic sheeting insulating layer such as polyvinyl chloride sheeting in that it is hard and resistant to indentation whilst polyvinyl chloride sheeting is subject to serious indentation under heavy pressure, the tendency to indent increasing with increasing thickness of sheeting.

Other non-conductive resin compositions may if desired be used. Examples of other resins include low viscosity epoxy resins in which certain grades of pitch (such as are manufactured by the Midland Tar Company) are incorporated and polyurethane resin compositions which may comprise polyurethane varnishes such as the proprietary material PV15 sold by Furniglas Limited.

Polysulphide rubber compositions, bitumen impregnated papers, solutions of bitumen and shellac, and the like are further examples of materials which may with advantage be employed in the formation of the insulating layer.

The conductive wear layer may be of any convenient material. It may comprise a continuous sheeting or be in the form of discreet parts such as tiles, and in the latter case it is of course necessary to ensure electrical linkages between the tiles to provide surface to surface conductivity. The wear layer may for example comprise polyvinyl chloride or other

polyvinyl flooring material rendered conductive by the incorporation therein of a proportion of a conductive substance. An example of an eminently suitable material for the conductive wear layer is that described in Specification No. 998,745. The thickness of the wear layer should be sufficient to provide a flooring having acceptable wear properties and thus a thickness of at least 0.04 inches and, more commonly, at least 0.05 inches is preferred. The maximum thickness is limited by economic considerations, and will not under normal circumstances be greater than 0.5 inches, and usually not greater than 0.25 inches. A convenient thickness for the wear layer is in general about 0.08 inches.

As stated above, the conductive wear layer is preferably applied on to the insulating layer using an electrically conductive adhesive. The adhesive may comprise an adhesive agent having dispersed therein a conductive substance, preferably graphite or conductive carbon black. The agent can for example be a resinous substance and a preferred adhesive is based upon a synthetic resin such as an epoxy resin. Suitable epoxy resins for the purpose include "Epikote" and "Araldite" RY152 epoxy resins as mentioned above and also "Araldite" GY 260 as sold by Ciba. Convenient hardeners for "Epikote" and "Araldite" RY 152 are "Epikure" RTV and "Araldite" HY152 respectively, whilst for "Araldite" GY 260 a suitable hardener is "Araldite" HY 960. One convenient adhesive composition comprises 50 parts of epoxy resin plus hardener to 44 parts of graphite, the latter being preferably finer than 200 mesh. In general, of course, the greater the proportion of graphite or other conductive substances in the adhesive the better will be the conductive properties thereof but the proportion is preferably kept to a minimum commensurate with adequate conductivity. Alternative adhesive agents suitable for use in the adhesives include for example neoprene rubbers.

The adhesive is conveniently spread on to the insulating layer to provide a continuous coating, and the thickness of the adhesive coating will preferably be as low as possible having regard to the need for the coating to be continuous. The conductive wear layer will then be applied on to the coating of adhesive and the coating then hardened. Where the conductive wear layer is in the form of discrete parts such as tiles, the adhesives will supply the necessary electrical linkages between the parts.

Finally, an electrical connection must be provided from the conductive wear layer to earth via a predetermined resistance which is selected to provide the desired antistatic and/or conductive properties. This may take the form of a conductive metal, e.g. copper strip set in the flooring below the wear layer but in electrical contact therewith together with

a wire leading from the metal strip to a resistance which is itself earthed. Where a conductive adhesive is used in the laying of the wear layer, the metal strip may be conveniently set in the adhesive as it will thereby be in electrical contact with the wear layer. The dimensions of the strip may vary widely. One suitable copper strip is about 1" wide, about 2" long and about 0.005" thick.

The value of the resistance will, as explained above, vary according to the circumstances in which the flooring is to be used. In general, however, we have found that a resistance in the range of 100,000 ohms to 2 megohms is preferable for antistatic floorings, and for many purposes a resistance of about 1 megohm has proved particularly suitable. Whilst not usually necessary, it is of course possible if so desired to have a variable resistance in the system so that adjustments can be made with varying circumstances.

The method according to the invention will now be further illustrated by reference to the accompanying drawings, in which:

Fig. 1 is a cross-section of a flooring laid in accordance with the invention, and

Fig. 2 is a cross-section of an alternative form of flooring also laid in accordance with the invention.

Referring first to Fig. 1, a flooring base 1 has formed thereon an insulating layer 2 of an epoxy resin composition. At the edges of the flooring adjacent to walls 3, the epoxy resin layer is raised as shown at 4. A coating 5 of a conductive adhesive is provided on the epoxy resin layer 2, the coating 5 binding a conductive wear layer 6 formed of antistatic tiles to the epoxy resin layer 2. The conductive wear layer 6 is separated from the walls 3 by a gap about $\frac{1}{4}$ " in width, which gap can if desired be covered with a cove-base welded to the floor. The raised portions 4 of the epoxy resin layer 2, which are each about 1 inch in width serve to prevent the adhesive coating 5 coming into contact with the walls 3. A copper strip 7 is set in the adhesive coating 5 and connected via an insulated wire 8 to a resistance 9. The resistance 9 is in turn connected to earth.

In Fig. 2, the epoxy resin layer 2 is replaced by a plasticised polyvinyl chloride sheeting 10. The sheeting is turned up at its edges 11 adjacent to walls 3, the turned-up edges serving the same purpose as the raised portions 4 of the epoxy resin layer 2 of Fig. 1.

In use, the flooring base 1 is completely insulated from the conductive wear layer 6 by the epoxy resin layer 2 or the plasticised polyvinyl chloride sheeting 10. Thus leakage of electrostatic charge from the wear layer 6 takes place only via the resistance 9 and the surface to earth resistance of the flooring depends only upon the value of the resistance 9.

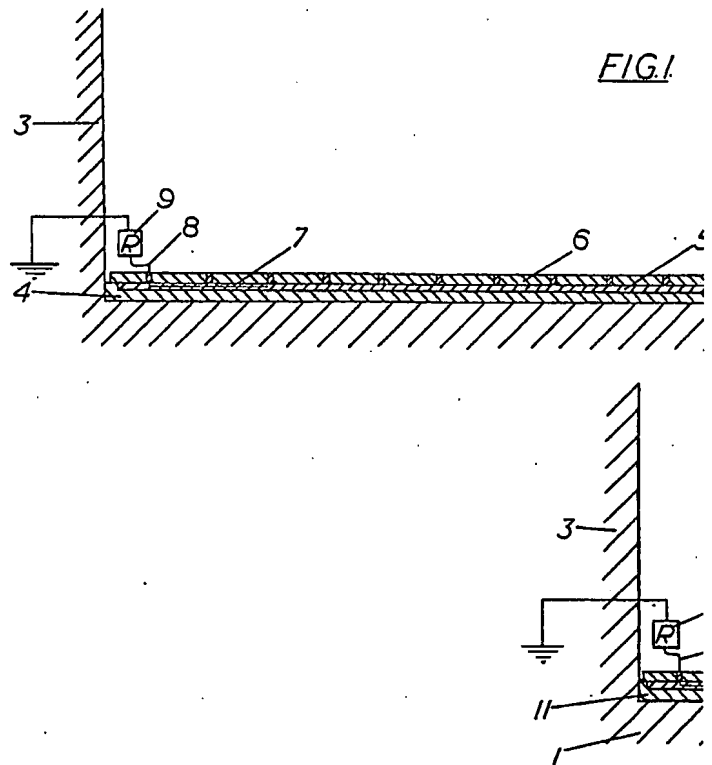
WHAT WE CLAIM IS:—

1. A method of laying a flooring possessing predetermined antistatic and/or conductive properties which comprises first providing the flooring base with an electrically-insulating layer, applying on to the said insulating layer a conductive wear layer and providing an electrical connection from the conductive wear layer to earth via a predetermined resistance which is selected to provide the desired antistatic and/or conductive properties.
2. A method as claimed in claim 1 in which the wear layer is applied to the insulating layer using an adhesive.
3. A method as claimed in claim 2 in which the adhesive is electrically-conductive.
4. A method as claimed in any of the preceding claims in which the insulating layer is provided by thermoplastic sheeting.
5. A method as claimed in claim 4 in which the sheeting is of polythene, polyvinyl chloride or other polyvinyl resin.
6. A method as claimed in claim 4 or claim 5 in which the insulating layer has a thickness of at least 0.005 inches.
7. A method as claimed in any of claims 4 to 6 in which the thermoplastic sheeting is applied to the flooring base using a non-aqueous adhesive.
8. A method as claimed in claim 7 in which the adhesive is a non-aqueous bitumen adhesive.
9. A method as claimed in any of claims 1 to 3 in which the insulating layer is formed on the flooring base by application to the flooring base of one or more coatings of a hardenable resin composition which is hardened after application.
10. A method as claimed in claim 9 in which the hardenable resin is an epoxy resin.
11. A method as claimed in claim 10 in which the hardenable resin composition comprises the epoxy resin together with a non-aqueous, non-conductive filler.
12. A method as claimed in claim 11 in which the filler comprises sand.
13. A method as claimed in any of claims 10 to 12 in which at least two separate coatings of epoxy resin composition are applied to the flooring base.
14. A method as claimed in claim 13 in which the first coating is made with an epoxy resin composition comprising epoxy resin, non-aqueous, non-conductive filler and an epoxy resin hardener, the second coating being made with an epoxy resin composition consisting essentially of epoxy resin and epoxy resin hardener only.
15. A method as claimed in any of claims 9 to 14 in which the insulating layer is at least 0.005 inches thick.
16. A method as claimed in any of the preceding claims in which the conductive wear layer comprises a continuous sheeting.
17. A method as claimed in any of claims 1 to 15 in which the conductive wear layer comprises a plurality of tiles with electrical connections between the tiles.
18. A method as claimed in any of the preceding claims in which the conductive wear layer comprises a polyvinyl resin flooring material rendered conductive by incorporation of a proportion of a conductive substance.
19. A method as claimed in claim 18 in which the conductive wear layer is a polyvinyl chloride homopolymer or copolymer flooring material produced as claimed in any of claims 1—39 of Specification No. 998,745.
20. A method as claimed in claim 18 in which the conductive wear layer is a polyvinyl chloride homopolymer or copolymer flooring material as claimed in any of claims 41—47 of Specification No. 998,745.
21. A method as claimed in any of the preceding claims in which the wear layer has a thickness of at least 0.04 inches.
22. A method as claimed in claim 21 in which the wear layer has a thickness of at least 0.05 inches.
23. A method as claimed in claim 22 in which the wear layer has a thickness of from 0.05 to 0.25 inches.
24. A method as claimed in any of the preceding claims in which the wear layer is applied to the insulating layer using an adhesive composition containing a conductive substance.
25. A method as claimed in claim 24 in which the conductive substance comprises graphite or conductive carbon black.
26. A method as claimed in claim 24 or claim 25 in which the adhesive composition comprises an epoxy resin, a conductive substance and an epoxy resin hardener.
27. A method as claimed in any of the preceding claims in which the electrical contact from the conductive wear layer to earth is provided by a conductive metal strip below the wear layer but in electrical contact herewith and electrically connected to an earthed resistance.
28. A method as claimed in claim 27 in which the metal strip is set in conductive adhesive used to apply the wear layer to the insulating layer.
29. A method as claimed in claim 27 or claim 28 in which the conductive metal strip is a copper strip.
30. A method as claimed in any of the preceding claims for the production of a flooring having antistatic properties in which the resistance between the conductive wear layer and earth is from 100,000 ohms to 2 megohms.
31. A method as claimed in any of the preceding claims in which the resistance between the conductive wear layer and earth is a variable resistance.
32. A method as claimed in claim 1 substantially as herein described.
33. A flooring possessing antistatic and/or

- conductive properties and laid by a method as claimed in any of claims 1 to 32.
- 5 34. A flooring possessing predetermined antistatic and/or conductive properties which comprises, on a flooring base, (1) an electrically-insulating layer and (2) a conductive wear layer separated from the flooring base by the said insulating layer, there being provided an electrical connection from the conductive
- 10 wear layer to earth via a predetermined resistance which is selected to provide the desired antistatic and/or conductive properties.
- 15 35. A flooring as claimed in claim 34 in which the insulating layer is as defined in any of claims 4 to 6.
36. A flooring as claimed in claim 34 in which the insulating layer comprises an epoxy resin.
- 20 37. A flooring as claimed in claim 36 in which the insulating layer comprises a first lamina comprising epoxy resin together with non-aqueous, non-conductive filler on the flooring base and a second lamina formed on the first lamina, the said second lamina consisting of epoxy resin substantially free from filler.
- 25 38. A flooring as claimed in claim 36 or claim 37 in which the insulating layer is at least 0.005 inches thick.
- 30 39. A flooring as claimed in any of claims 34 to 38 in which the wear layer is as defined in any of claims 16 to 23.
40. A flooring as claimed in any of claims 34 to 39 in which electrical contact from the conductive wear layer to earth is provided by a conductive metal strip below the wear layer but in electrical contact therewith and electrically connected to an earthed resistance.
- 35 41. A flooring as claimed in claim 40 in which the conductive metal strip is a copper strip.
- 40 42. A flooring as claimed in any of claims 34 to 41 in which the resistance between the conductive wear layer and earth is from 100,000 ohms to 2 megohms.
- 45 43. A flooring as claimed in any of claims 34 to 42 in which the resistance between the conductive wear layer and earth is a variable resistance.
- 50 44. A flooring as claimed in claim 34 substantially as herein described.
- 45 45. A flooring as claimed in claim 34 substantially as herein described with reference to Fig. 1 of the accompanying drawings.
- 55 46. A flooring as claimed in claim 34 substantially as herein described with reference to Fig. 2 of the accompanying drawings.

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1 SHEET

AMENDED SPECIFICATION
*This drawing is a reproduction of
the Original on a reduced scale*

